

IDEAL STABILITY CALCULATIONS FOR ARIES COMPACT STELLARATOR CONFIGURATIONS

A.D. Turnbull and L.L. Lao
General Atomics

**Presentation for the ARIES Compact Stellarator
Project Meeting**

Livermore
May 7 - May 8 2003

ACKNOWLEDGEMENTS

Contributions to this work from several colleagues are greatly appreciated:

W.A. Cooper (CRPP/EPFL) for aid in porting TERPSICHORE to local systems and aid in running it

Long-Poe Ku (PPPL) for providing initial ARIES Equilibrium

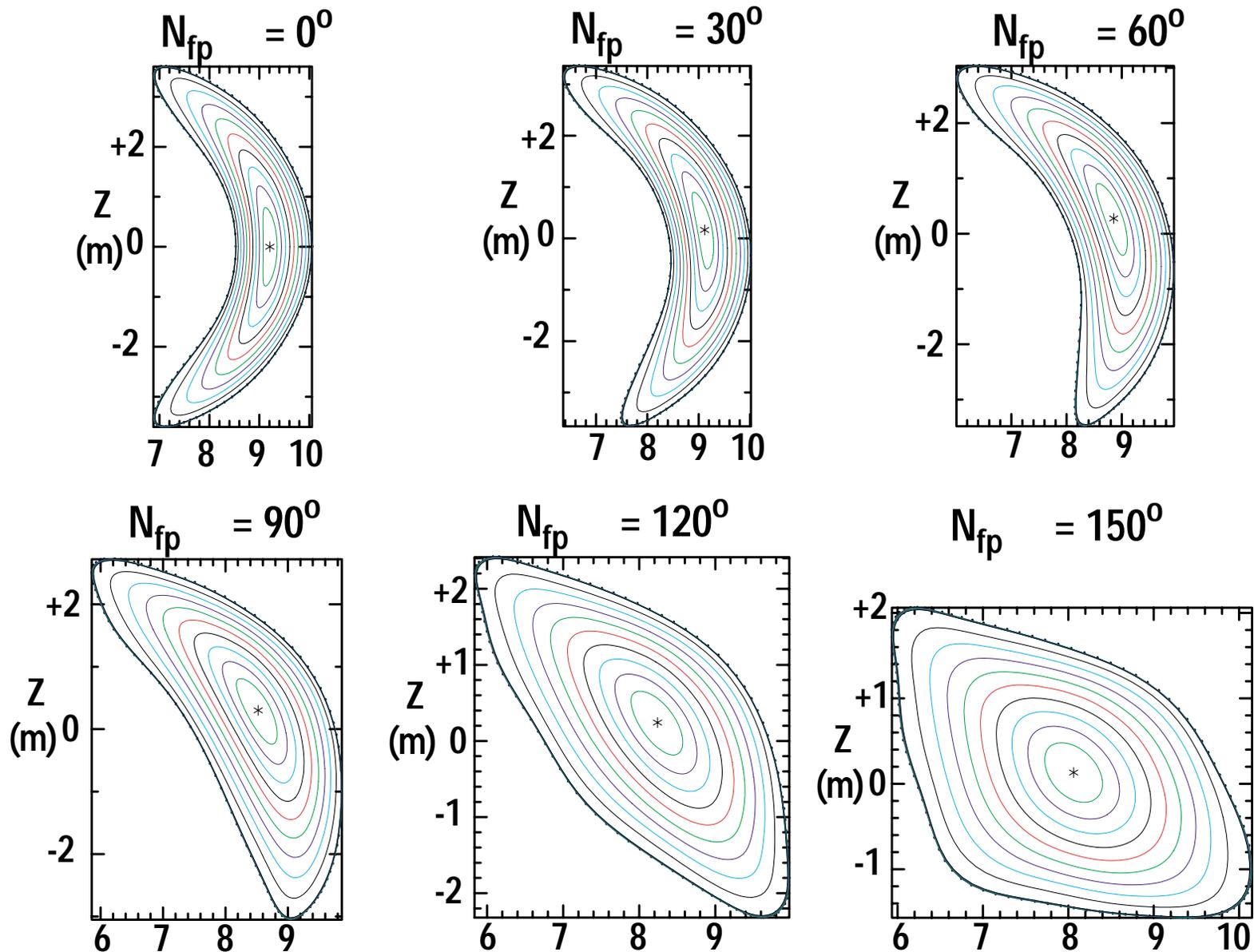
STABILITY ANALYSIS PLANS FOR 2003

- **Port TERPSICHORE to local GA Linux workstation:**
 - Assistance from W.A. Cooper with non source code libraries
 - Assistance from G.Y. Fu (PPPL) with interpretations
- **Obtain equilibrium from VMEC (M.C. Zarnstorff PPPL):**
 - Stability analysis using TERPSICHORE for significant range of toroidal mode number n
 - Monitor high n stability but ignore for optimization
 - Increase β or estimate modifications to plasma parameters required to stabilize
- **Modify VMEC equilibrium accordingly (M.C. Zarnstorff):**
 - Iterate with stability analysis using TERPSICHORE
 - Converge on final equilibrium when β limit is reached and simple adjustments to other parameters are ineffective
- **Reconstruct free boundary equilibrium using PIES (M.C. Zarnstorff):**
 - Modification to coils and plasma parameters to reproduce a reasonable set of free boundary nested surfaces
- **Iterate with VMEC and TERPSICHORE calculations:**
 - Linear resistive and nonlinear MHD calculation of final equilibria

PROGRESS JANUARY 2003 TO MAY 2003

TASK	STATUS	COMMENTS
Port Terpsichore	Done February 2003	Terpsichore now running on GA Linux system (Lohan1) Benchmarked for LHD and QHS cases (with A.W. Cooper)
Obtain Base VMEC Equilibrium	Done March 2003	Obtained scaled NCSX equilibrium from PPPL to use as starting point (with Long-Poe Ku)
Stability Calculation using Terpsichore	In Progress April 2003	Rewritten interface between VMEC and Terpsichore to use PPPL and GA VMEC and CRPP Terpsichore versions
Modify VMEC Equilibrium and check stability robustness	In Progress April 2003	Reproduced PPPL scaled NCSX equilibrium using GA VMEC version
Free Boundary Equilibrium from PIES	Not Done	This should be done in the long run but is beyond present resources
Iterate Equilibrium and Stability	Not Done	This should be done in the long run but is beyond present resources

NCSX Equilibrium Scaled to ARIES Compact Stellarator: $\sqrt{\quad}$ Contours



NCSX Equilibrium Scaled to ARIES

Compact Stellarator: $\sqrt{\quad}$ Contours

